

Improvements and Additions to the Entrepreneurship Ideation Laboratory

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ABSTRACT

Entrepreneurs and successful businesses recognize that innovation is a major driving force behind new businesses, especially within the field of product development. The Industrial Technology (IT) department embraces Cal Poly's "learn by doing" approach by incorporating laboratory work into the curriculum. The IT labs need to be continually updated and reconfigured, as to be more responsive to the evolving technology of California's economy. Moreover, there is a unique opportunity for Industrial Technology graduates, especially with the addition of the Entrepreneurship concentration, to use their education and skills to start and grow a business. This senior project evaluates the current status of the Entrepreneurship Ideation Laboratory (completed in 2009), as well as makes changes and improvements to the lab to meet the evolving needs of the Industrial Technology program. After reviewing literature on the topics of ideation, brainstorming, and prototyping, the solution was to create a set of ideation "kits" for the lab and attempt to create an inspiring, creative atmosphere for the students. This report will summarize the research performed as well as explain in detail the project's solution.

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INTRODUCTION

Problem Statement

This purpose of this project is to meet the evolving needs within the Industrial Technology (IT) program at California Polytechnic State University. More specifically, this project focuses on improvement of the Entrepreneurship Ideation Laboratory (EIL), a space which provides students with design tools to transform raw ideas into “soft” prototypes. In September of 2008, a planning team of faculty from across a range of disciplines was formed to take on the project of turning the old textiles lab into the new Ideation Laboratory. The facility was completed in the Fall of 2009 and was intended to be used as a supplement space to the IT courses, especially following the addition of the Entrepreneurship concentration.

The IT labs need to be continually updated and reconfigured, as to be more responsive to the evolving technology of California’s economy. The Entrepreneurship lab is less than a year old and thus is still in the beginning stages of development. This project is aimed at tackling problems that could not be solved at the time of construction, while also allowing for the input and creativity from a group of senior students.

What the technical advisors of this project expect in terms of the solution and outcome is to identify the key users of the Entrepreneurship lab as well as their specific needs. In addition, research needs to be done to find the ideal design resources and tools in order to assist students in the product conceptualization process, from brainstorming to prototyping. The deliverables could include: physical “kits” (such as IDEO uses), practices or approaches that have been successful within the industry, access to resources or programs that could accelerate faculty and student’s use of the lab. Upon completion of this report, an oral presentation will be made to the IT 462 class and Industrial Technology faculty, and copies will be delivered to faculty advisor and to the Robert E. Kennedy library.

Needs

One of the more significant problems with the EIL is that it was created without a specific use in

mind. Moreover, its users which include students, faculty, clubs, and potentially other departments or local businesses- all have a different idea of how it should be used. The space needs to be flexible enough to accommodate multiple users, but also have specific purposes to make it the most effective. The challenge is to transform the lab into a multi-dimensional space which will promote creativity and innovation, provide design tools and materials, and provide its users physical access to the room, with the limited time and resources provided this project.

In addition to a classroom for the Entrepreneurship concentration, the lab was also envisioned be a gathering place for students outside of the class to develop ideas and work on team projects. The culture and foundation of the IT program emphasizes working in teams, approaching problems from a hands-on perspective, and lab-based team projects. Currently, there is no communal space where students can gather, aside from student's houses or the campus library, which lack the tools and space to complete most assigned projects.

From preliminary faculty interviews, it was determined that location was the primary concern, which is the one aspect that cannot be changed about the lab. Other concerns from the faculty included: location of computers, software capability, seating arrangements, lab availability and identity. Based on the student surveys, it was discovered that the students are not particularly aware of the lab's purpose, but they are excited about the possibility of using the space. The students envision the lab as being a place to work on group projects, research, place to make prototypes and brainstorm.

There is also a unique opportunity for the EIL to eventually become a resource to more departments on campus, the local community, and even industry professionals. This is more of a long-term goal that could be addressed when the lab's use is increased and is more efficient. However, this need is a one that will be addressed within the scope of this project.

Five needs are presented below, starting with the most important.

1. Promote innovation and creativity through the physical environment: The lab is a large classroom with lots of empty space with white walls and white boards. The decorations are minimal and do not inspire the creativity the space needs to fulfill. Display cases and bright

colors could fulfill this need.

2. Provide students with the necessary tools to develop “soft” prototypes: There are some materials and tools in the lab but they are not organized, nor fit the needs of the users. Additional materials may include packaging books, prototype software or videos.

3. A flexible space that meets specific needs of users: An empty classroom does not meet the student nor faculty’s needs. The space needs to be flexible enough to accommodate multiple users.

4. Access to space and scheduling logistics: Currently, the lab is locked when not in use. Selected users (mostly faculty) are provided access through the keypad lock on the door. Students do not have open access to the lab. There is also no set or published schedule of when the lab is being used.

5. Funding: This lab was created with a limited budget and a large percentage of this was used in the construction and remodel of the room. The lab’s users could benefit from a small budget to make continual changes and improvements to the lab.

Background & Related Work

The EIL’s initial planning team was inspired by Stanford University’s comparable facilities and the product development firm IDEO. IDEO’s strategy for innovation is a human-centered approach that ties innovation to the customers’ underlying needs, involves quick prototyping and heavy use of brainstorming. Tim Brown, the CEO of IDEO explains their approach, “Design thinking is an approach that uses the designer’s sensibility and methods for problem solving to meet people’s needs in a technologically feasible and commercially viable way. In other words, design thinking is human-centered innovation.” In 2000, IDEO worked closely with Stanford to design a new research facility, The Stanford Center for Innovations in Learning (SCIL.) The space IDEO delivered was flexible enough to support a wide range of research activities from smaller, private breakout rooms up to large-scale presentation areas. The facility became an independent research center that conducts research related activities to advance a wide range of studies. The Institute of Design at Stanford University or “d.school” has become a central hub for students across a wide range of disciplines in order to apply design thinking to solve big problems in a human centered approach.

A number of other studies have been conducted that are closely related to this project and will be addressed in the Literature Review. One particular study that directly pertains to this project is a study done by Cece Reyes that focuses on the effect of brainstorming and prototyping within the Industrial Technology 407 class, *Applied Industrial Product Design*. Additional topics will include but are not limited to: value of prototyping, tool use, team dynamics, best learning environments, problem solving, and design thinking approaches.

Potential Solutions

In terms of coming up with a solution to meet our customer's requirements, this would most likely be a new design for the space as well a method for users to access the room. Design ideas that have been considered are as simple as painting the walls to add color, to installing clear display cases to show innovative products. Other ideas are to put up large posters on the walls with brainstorming techniques. With a limited budget, the room would most likely be stocked with tools and supplies that faculty already have. For accessing the room, the most likely solution would be for each course to have a specific key access code. Students could register for a "1 Unit" lab class that would offer them access to the room, while also allowing them to accept responsibility when using the space. When there is a class or club meeting scheduled in the lab, the key access code could be deactivated so others could not enter the lab during those times. These are preliminary solutions that have been thought out but most likely will be expanded following research.

Contributions

This project is intended to support the students and faculty in the lab-based portion of the IT curriculum, but has the potential to contribute to the University as a whole and the local community. The primary goal is to enrich student's education by providing them with the opportunity to learn the skills to start and grow a business. Additionally, faculty will benefit because it provides additional space and supplies for their students to work on individual and group projects. The results of this project could also draw new students to the IT or Entrepreneurship program or the college by sparking their interest in technological innovation through the lab. Rather than having the college draw money from fees or contributions, the

research performed by this group is done at no cost, and as a contribution back to the IT program.

Project Scope

The biggest limiting factors within this project are time and money. With less than 20 weeks, there is only so much research that can be done and changes that can be made. A small discretionary budget does not allow for large improvements and changes that can be made to the lab, and thus this project will have to depend more on faculty and/or companies to provide the necessary tools and supplies. Due to the fact that this is a new lab and is still in the beginning stages of development, it will take more work to determine the needs of its users and will benefit from continuous improvement. Ideally, the project will involve less research and be more focused on designing and building lab improvements.

LITERATURE REVIEW

This purpose of this project is to meet the evolving needs within the Industrial Technology program at California Polytechnic State University. The Entrepreneurship Ideation lab has the potential to meet this need by providing the resources in order to incorporate more design thinking into the IT major, as well as advancing the department as a whole. The lab's initial objective was to be a space that provides students with design tools to transform raw ideas into "soft" prototypes. The lab was also envisioned to be a gathering place for students outside of the class to brainstorm, develop ideas and work on team projects. This literature review is intended to support and strengthen our knowledge on the practice of innovation and ideation related to entrepreneurship. The research will address innovation as a strategy, the ideation process, and innovation as a culture. In addition, research was done on the topics of brainstorming and prototyping. The literature review also discusses successful methods that have been performed in industry that can be implemented into the Ideation lab.

Innovation as a Strategy

It is not difficult to argue that innovation has become a major driving force behind new businesses, especially within the field of product development. Entrepreneurs across the world recognize that ideas and innovation are the most precious currency and that they drive the flow of business. Innovation can be viewed as a process, or system, with specific elements that foster success. Entrepreneurs and successful companies have learned not only how to innovate, but have also learned how to use innovation as a centerpiece of corporate strategy.

Renowned product design firm, IDEO, has mastered the art of innovation, and engages in a unique blend of methodologies, work practices, culture, and infrastructure. IDEO's strategy for innovation is a human-centered approach that ties innovation to the customers' underlying needs, involves quick prototyping, and heavy use of brainstorming. More recently, IDEO has moved from strictly being the "innovation experts", to helping companies attempt to remake their corporate cultures in order to become more innovative.

While companies like IDEO, Apple, or Google are leaders in innovation and design today, Thomas Edison was the first to turn innovation into a science by creating the first dedicated research laboratory. This research lab or “invention factory” created a new way of thinking and working, and was filled with all sorts of materials, which allowed for the “rapid and cheap development of an invention.” In addition to being an inventor, he was also a successful businessman who patented over 1,000 inventions during his lifetime. Edison once said, “To invent, you need a good imagination and a pile of junk.” Edison’s process thinking is not very different from the processes used by successful companies today.

Ideation & the Innovation Process

“Effective ideation is a vital part of a solid idea-to-launch system – a critical best practice.”

(Cooper-Edgett, 2008) Ideation can be defined as a systematic search or process for targeted opportunities in the form of new features, new products, new markets and new services.

(Simpson, 2009) Companies often engage in various ideation techniques in order to create a larger pool of ideas and to engage in creative problem solving. One of the most popular ideation techniques is brainstorming, which encourages group collaboration in order to build on other’s ideas. IDEO executive Tom Kelley describes one of their approaches- “Brainstorming is not just a valuable creative tool...its’ also a pervasive cultural influence for making sure that individuals don’t waste too much energy spinning their wheels on a tough problem when the collective wisdom of the team can get them “unstuck” in less than an hour.” Ideation is just one of the critical steps in the innovation process.

Innovation has become less and less closed-door R&D and more open- by engaging more employees, involving the actual customers, and bringing on field experts in order to improve the success of the process. IDEO’s innovation methodology can be summarized into five well-defined, basic steps:

1. Understand the market, the client, the technology, and the perceived constraints on the problem.
2. Observe real people in real-life situations.
3. Visualize new-to-the-world concepts and the customers who will use them.
4. Evaluate and refine the prototypes in a series of quick iterations.

5. Implement the new concept for commercialization. (Kelley-Littman, 2001)

What IDEO has done is created a culture of innovation, which encourages employees to explore wild ideas while also tolerating occasional failure. What is different and makes their methodology so successful is that they don't just teach the process of innovation; they actually do it, day in and day out. (Kelley-Littman, 2001)

Innovation and Ideation as a Culture

It is important to recognize that while IDEO has shared their secret "step-by-step" innovation strategy with the world, they still remain to be America's leading design firm, which suggests that there is something unique about their culture and design practice. Interestingly, IDEO's approach to innovation begins with chaos. While their methodology is refined through a series of steps, their culture brings life, fun, and learning, which creates a unique process.

Additionally, IDEO recognizes the importance of designating a space just for creativity and innovation. Their office space is eclectic in nature and appears to be a "work and play" process. The most innovative work is done through the formation of cross-functional (*x-func*) teams, which bring together people from multiple disciplines in order to create more diverse and powerful brainstorming sessions. When it comes to design space, their approach is "the less rules, the better" and is more focused on what, physically, is within the space. IDEO employees celebrate their space with prototypes they've worked on, found art, and clever mechanical toys. (Kelley-Littman, 2001) Even the CEO, David Kelley's office is filled with thousands of collected items over his 20 years at IDEO. "IDEO has made a science of accumulating junk." (Hargadon-Sutton, 2000)

The physical space itself also includes all the necessary tools and materials to make a paper airplane, to creating a forty-foot long prototype of an Amtrak train. Most of these materials are on carts with wheels, making them movable to just about any space. One cart, dubbed the "Tech Box" includes hundreds of items such as mechanical parts and various odd materials, complete with an iMac computer. This Tech Box has become a launching point for many projects and helped to improve our creative process. (Kelley-Littman, 2001) The importance of a designated space for innovation is often overlooked by many companies, but IDEO knows that success

depends on this philosophy- “You’ve got to create a culture where space matters.” (Kelley-Littman, 2001)

Brainstorming

“The best way to get a good idea is to get a lot of ideas” – Linus Pauling. This phrase summarizes the idea behind brainstorming in a perfect way. When a corporation, private business, or even a group of students is looking for a solution to a problem, often their best bet is to think of as many possible ideas as possible, and then narrow down the options from there. Brainstorming itself can be defined as a “group creativity technique designed to generate a large number of ideas for the solution of a problem.” The essential idea here is to share and build on ideas of others, in the hopes that in doing so these potential solutions will eventually lead to the fix of a problem. Successful product design firm, IDEO engages in brainstorming as an ideation technique, and as a result countless other companies look towards IDEO when they need assistance solving a problem, and consult them for ideas, innovations, and even brainstorming teams when needed. Brainstorming is often used to kick-off projects, to help get the extra boost of energy needed for a team to be successful, or perhaps gain that slight edge over a competitor, which is invaluable in today’s market. It can also be used to discover creative problem solving techniques and/or ideas, which a company might use along an existing product line as well as an up-and-coming one. One of the common roadblocks associated with brainstorming is that it initially goes against all human nature, so individuals truly believe that they already “brainstorm” on a daily basis within their company when in fact they couldn’t be further from it.

Research has found that the main premise behind the brainstorming philosophy is to defer judgment. As individuals, we are constantly analyzing and judging each and every thing in life, whether it be conscious or not. This is simply the way society works, and there is not necessarily ill intent involved with this type of judgment. The basis of brainstorming works directly against this aspect of human nature, and those involved in a brainstorming session must work hard to control their thoughts regarding the issue of judging others’ ideas, whether they be spoken objections or simply intellectual oppositions. One of the main factors regarding judgment stems from the necessity of establishing varied groups of what IDEO refers to as “brainstormers” before the session even begins. The group should have a designated leader, however not one that

will take control or dominate the room but rather direct the group by keeping the members on track, and establish the rules and guidelines beforehand. A cross-functional team will help bring more diverse perspectives to the table, and helps ensure variegated results, which presents a wider chance for success.

IDEO alludes to the idea that brainstorming is a *skill*, and something that can continually be improved upon. Some even go so far as to call it an art. As stated above, once a varied group of the proper size has been established and brought together, the team leader must then work to lay out the ground rules, and clearly demonstrate what the problem is they are trying to solve. The leader must work to keep the group focused on the common goal, while simultaneously encouraging wild ideas that build on other group members' ideas, but only allow for one conversation at a time. However, there should be no set order in which people are allowed to express their opinions and in fact the more random the order the better. If a member has something to say, he/she should express it as soon as possible, without interrupting another member though, of course. As always, judgment of other ideas should be all but eliminated as per the rules of brainstorming. There should be a media readily available upon which group members can scribble down their ideas- such as a wall covered in post-it notes, or a blank white board with markers easily accessible.

When all of this comes together in a common place at the proper time, great things can happen. Problems that have plagued businesses, corporations, or student groups can be eradicated in a single brainstorming session, which might last less than 45 minutes.

In a 10-week study performed at California Polytechnic State University at San Luis Obispo, the progress and practices of four teams were observed in an effort to understand the activities that surround brainstorming and to determine if, with a bit of training and tools, students are able to use and improve their brainstorming skills to discover innovated solutions. (Reyes, 2009) The results of the study found that students felt that brainstorming was a bad use of their time, and none of the teams were comfortable with carrying out the process during a scheduled lab session. Issues that prevented the students from benefiting from brainstorming could be from the teams not knowing how to constructively brainstorm and also the lack of access to research and

prototyping tools. IDEO and Stanford University have found that brainstorming is most effective when it is incorporated into their culture and way of life. *The Art of Innovation* written by IDEO executive Tom Kelley, emphasizes their companies policies and practices regarding brainstorming an innovative thinking. In this book Kelley shares seven “secrets” that IDEO uses to enrich their innovative environment, and all of these already are, or can be with little effort, incorporated into the Industrial Technology Ideation Lab. They include sharpening the focus of the room, which is the job of the team leader or facilitator. He or she must keep the group on track and pointed in the right direction, while simultaneously allowing and even encouraging random, wild comments and ideas, which is the second rule. The third rule involves numbering the worthy ideas that come out of the session, but being careful not to take notes that are too copious and detailed. The fourth step involves the team members, and how they “jump” off of each other’s ideas to further the process and keep the session lively and up-beat, which are then written down as per step five on the provided media. This may be a wall covered in post it notes, a blank white board, or even simply paper and a pen as long as it is readily available and clear to all members of the group. If these techniques had been learned by the students in the Brainstorming study, the number of ideas and prototypes may have been increased as well as the quality of the projects with respect to their design.

Steps six and seven involve the space of the room itself as well as those who use it. It is necessary to have a designated space and time in which the group can “stretch their minds” in a warm up process that may or may not be led by the group leader. This often occurs if members of the group do not know each other well at the time of the brainstorming session. The seventh step involves getting physically involved with the potential ideas in the form of sketches, maps, diagrams, foam blocks, Legos, and duct tape. At IDEO, these materials are often provided to employees in the form of “Ideation Kits” which encourage rapid prototyping and help instigate positive innovative thinking. Accessibility to these tools and necessary materials in general is perhaps the one thing that may have hindered students in the Cal Poly Brainstorming study.

Tom Kelly also lists six ways to kill a brainstorming session in his book, all of which negate the “seven secrets” listed briefly above. At IDEO, these rules and secrets are displayed clearly above the brainstorming whiteboards, which are visible for everyone within the room. An

effective brainstorming session is critical to the innovation process and has the opportunity to take a project or a team to the next level.

Prototyping

In the field of innovation and ideation there are many times when a crude model of the product being designed may be necessary to move forward with the project; these crude models are a form of prototype. There are a number of stages of prototypes that range from glue tape and paper to a full working models made from the very same materials soon to be found in the final product. There are many reasons a company would benefit from the use of prototypes, but the paramount reason behind the use of prototypes is to spark creativity and to understand the physical properties of the product being innovated.

One thing to recognize about the concept of prototyping is that anything whether it be a product, service, or idea, can be prototyped. There are a number of benefits to prototyping your ideas many times before you even have a final design. One big factor driving the use of prototyping at companies such as IDEO is they force communication between the project team and upper management. In a “traditional” design environment it would not be unusual for a manager to assign a design team a task with a number of goals and a time line. In this scenario it would also not be unreasonable to assume this team would then work on the project for several weeks or months then finally present their findings to the manager after the project has reached its conclusion. Some of the time this method may work flawlessly, but there will be times where the manager is unhappy with the direction the project has taken or has not laid out clear goals for the team. If you take this same scenario and have the team prototyping their designs from a very early stage the manager and team will be able to catch such miscommunications well before the end of the project.

The ability to use and interact with the product can lead to a boost in creativity and allow the user to understand the physical dimensions of the proposed design, which is another benefit from prototyping. Tom Kelley, the General Manager of IDEO shares an example of this idea through a story about Brendan Boyle, a toy designer at IDEO designing a football. In the story Brendan is on a team designing a foam rubber football with built-in tee wings which hold the ball upright

for kicking. Using the materials he had available, Brendan made a very crude prototype in which he glued wings onto a football, however it turned out to be a very effective mock up to the final design. It was so effective that when the team began to throw the ball, they realized that the wings held a second function- they allowed the ball be thrown in a perfect spiral every time. From this simple and crude prototype the Aerobie football was born.

Tom Kelly once said “a picture is worth 1000 words and a prototype is worth 1000 pictures.” This shows just how important he feels that the prototyping stage is to the design process. This statement implies that despite all of the paperwork and design drawings, there is no replacement for a solid model you can hold in your hands. What you gain from holding a prototype is similar to the dramatic difference when you compare a picture to words on a page. The creation of prototypes also make complex projects seem very simple and understandable. Craig Lawrence also adds “One of the benefits of creating rough prototypes is that you reduce your emotional attachment to a concept.” This explains yet another benefit behind the use of prototyping, the idea that your product is dynamic and ever changing. If you build something as its not 100% what you want now it will be easy to make the necessary changes without wondering how it will affect the process.

There are many ways to build a successful prototype whether it be very rough or crude, or something very sophisticated. However, there are a few basic guidelines to remember when undergoing the prototyping process. These guidelines are set up to insure that the prototype is both successful and beneficial to the design. They are not meant to be constraints on innovation and are not hard fast rule, but basic principles that should be followed in order to make the process most beneficial.

Another important guideline is to be very specific about the problem you are trying to solve and how you are going to solve it. Each prototype should be aimed at answering one specific question, and the success of the prototype will be based on how it answered that question. When constructing prototypes, it is very easy to lose sight of the goal of the project and find yourself answering many questions at once, none of which are the question you set out to answer. One way to combat this is to remain specific and not deviate to far from the original path. When

building it is important to not focus on details unrelated to the specific question you are trying to answer.

When making your prototype it is important to remember that a often times a quick mock up will suffice for a full working model and it is not always necessary to spend hours working on a design that can be made out of paper and glue in two to three minutes. A good example of this is the way that most handheld electronics operating systems are built. While thousands of hours could be spent writing the code to test the new operating system, most companies will instead use post-it notes to mock the interface. With one post it note for every possible screen in the system it is easy to feel your way around to better understand how it will look. You can also easily test if the system has the functions you want while also being user friendly. This simple prototype can be made in a matter of minutes as opposed to weeks and will have most of the functionality of the final system.

One final guideline is to be creative in your problem solving and not fear what may seem to be crazy ideas. When IDEO wanted to test a new pair of ski goggles they had developed during the summer in San Francisco many recommended that they fly to New Zealand where the ski season was in full swing. Knowing that they didn't have the money of time for such a trip, they got creative and solved their problem in an untraditional way. They called up a local ice creamery and asked if they could use one of their full sized walk in freezers to test the pair of goggles. The creamery accepted and the employees of IDEO spent that afternoon in a freezer with an exercise bike and a fan in order to simulate skiing conditions. This is an example of how creative thinking can often save time and money while still solving the problem. "The process of prototyping can spark little innovations, the sort that can be the difference between a product's success and its failure." (Kelley, 2001)

While IDEO is no doubt the leader in the industry within product design and development, there are many other approaches that companies take to ideate. IDEO has shared their "innovation playbook" to the world but yet companies struggle with this idea. What can be learned from this is that individuals and companies much change how they think about innovation and must recognize that the right culture can greatly affect its success. This

“playbook” cannot be copied and must be altered to fit the company’s individual needs and fit its culture. It is also important to point out that IDEO doesn’t manufacture anything but ideas, which allows them to keep a sustainable competitive advantage. With respect to creativity and entrepreneurship, there is a shifting paradigm to create new business models. One advantage that companies have over our Ideation lab is more money. These companies have much higher budgets to implement new innovation techniques and educate their employees through training programs. However, one limitation that prevents these companies from becoming successful at innovation and ideation is the fact that it is much harder to change the culture of the large company than it is to change the culture of a smaller University department. This is most likely one of the reasons that some companies struggle with innovation and look outside for assistance in product development. There is a lack of research done specifically on the effect of ideation techniques within a classroom or lab setting. Stanford University has excelled within the field of design and has thus gained much external support to fund their impressive design lab. The Entrepreneurship Ideation lab is still in its beginning stages and has room for much improvement. This project aims at getting the attention of students and faculty as well as transform the lab into a more ideation friendly setting in order to incorporate design into the Industrial Technology major.

Needs	Met by others? (1-5 Scale)
<i>Promote innovation and creativity through the physical environment</i>	5
<i>Provide students with the necessary tools to develop “soft” prototypes</i>	5
<i>Create a flexible space that meets specific needs of users</i>	4
<i>Provide students access to space and scheduling logistics</i>	n/a
<i>Funding</i>	5

Figure I

It is difficult to completely evaluate the Ideation lab’s needs to how well they are met by others. IDEO and Stanford definitely excel in the area of promoting creative environments as well as providing users with the necessary tools to ideate. As students, we have the advantage of bringing a unique and different perspective to the process of applying ideation to the projects and work we do in the IT curriculum.

SOLUTION

This section will address a list of possible solutions that have been generated that seek to fulfill the purpose of the project. The purpose of this project is to identify the needs of the Ideation lab's users, as well as research ideation methods that have been proven successful in industry in order to create a space that fulfills these requirements. The goal of the Entrepreneurship Ideation lab is to provide IT students with a space to ideate, brainstorm, and create prototypes. Our project seeks to determine the lab's user's needs as well as transform the lab by providing the necessary design tools in order to create a unique space that will advance the IT program. While some preliminary solutions are discussed in the introduction section of the report, this section will address the solutions that we came up with after student and faculty surveys were performed, as well as the completed literature review. Initial solutions included: a new design for the space, stocking the room with a supply of on-hand tools and completed student projects, and open access for students. More specific and expanded solutions will be explained in this section, as well as the advantages and disadvantages of each. With each potential solution, we considered the following parameters: cost and time, feasibility, meeting the needs of the project's purpose, primary benefactors, and how it will effect faculty and student awareness.

Data Collection

A series of interviews and surveys were used to evaluate the faculty and student's attitudes and perceptions toward the Ideation lab. The first step that was taken toward collecting data was administering questionnaires to the IT student body. The purpose of this questionnaire was to gain insight into the following: how familiar students are with the Ideation lab, to what extent their faculty incorporate the lab into the IT classes, suggested improvements to the lab, and what purposes they might see in using the lab. Another question addressed the lack of space for IT students to work on group projects and their feelings on the implementation of a "IT student lounge." Another data collection method was used in the form of interviewing the faculty individually. This was done to find out how much the faculty are aware of the purpose of the lab and if they incorporate it into their classes. If faculty did not use the lab, it was asked to explain what hinders their usage. During the interviews, faculty were requested to give their input and suggestions of what they think would make the lab more useful for their classes.

Student-Centered

The first solution that we came up with is to create an “IT student lounge” which would allow students full, open access to the space where they could work on group projects together, socialize, and act as a central meeting location. With this solution, we wouldn’t change much to the lab itself, but would provide a way for students to access the space such as a key code that would change every quarter. We would most likely put couches and/or chairs for students to lounge and study, as well as put in more PC computers and a printer. Based on the student surveys, we concluded that IT students specifically do not have a common specified space to meet and work together. There are typically multiple group projects assigned to IT students each quarter, which often require an ample amount of physical space to complete. For example, in the IT 403 *Lean Manufacturing* class, groups of 5-6 students are assigned to create a “lean” process for making 25 individual cups of coffee within a time limit of 15 minutes. This project requires that students work together to come up with a creative solution to a complex problem. They would need a large amount of space to spread out the multiple coffee machines, bags of coffee, and 25 plus foam cups. Currently, there is no common space for this to take place aside from the campus library and student’s houses. We think that this solution has the potential to improve the quality of IT student projects because they will be provided a great open space to work on them, as well as the necessary tools. Additionally, it would most likely increase student usage and awareness of the lab. One problem with the current state of the lab is that students are not aware of the lab or its intended purpose. This solution addresses the need of providing students with access to the space and the need of keeping the lab a flexible space. However, there are several disadvantages to this solution. There are potential security issues regarding the computers and supplies in the lab. While the computers are locked to the tables, the tools and supplies are not and could be removed from the lab by the students. This could lead to disapproval of open access by the department as well as cost them money to replenish the supplies. Another issue is the safety of the students. With large cutting saws, industrial glue guns, and belt sanders, students could hurt themselves, resulting in a lawsuit for the University. It would be almost impossible for a staff member to be present in the lab to supervise the students. While it is possible to come up with creative solutions for security and safety issues, this solution does not address the need of advancing the department. The design aspect to the major is minimal, and the department

believes that design is the future and key to the industry, especially within product design. This alternative is moderately feasible due to the fact that it doesn't require huge costs, but it would be difficult to gain approval from the department about opening up the space for all IT students. Overall, this solution is directed towards the student needs but does not meet all the goals of the project.

Leave in Current State

One simple, yet potentially effective solution would be to just do nothing to the lab. This would include leaving the space as it is now- flexible and open, with limited access for students. One of the reasons this solution was explored is because the building where the lab resides was previously going to be torn down, but because of budget cuts, remained standing. This solution would benefit all types of the lab's users including: classes, faculty, students, and organized clubs. Currently the space is not dedicated to one specific function and is just a classroom with desks and chairs on wheels. This allows for almost anything to be done in the lab depending on what the instructor wants. The movable chairs and tables allow students to direct their attention to anywhere in the room and also allow them to gather into smaller groups. There are many brand new tools that are not being used in the Ideation lab that could be utilized in another lab. For example, the x-acto knives and cutting mats could go to the packaging lab. The safety goggles and tape measures could be used in the metals lab. Another advantage is that it would cost nothing. We have a limited budget to begin with, but this would save money to put into other areas within the department. Leaving the space as is has more shortfalls than advantages. One disadvantage is that it does not address the inadequacies of the current space and it does not meet the goals of the project. While it may leave the space flexible and allow for different types of uses, it does not promote innovation and creativity, does not provide a place for prototyping, does not increase student access and usage, and does not generate additional funding for the lab. It does not meet the evolving needs of the major. This solution is highly feasible because it does not require time or money from anyone.

Classroom Space

A third solution that we came up with was thought of with the faculty in mind. We could transform the lab into a strictly classroom space where lectures could be held. The advantage to

this solution is that it addresses the problem that budget cuts have created. With the budget cuts, teachers are forced to teach more classes which unfortunately creates a lack of classroom space. The space could also be used by faculty as “teacher breakout rooms.” Often times in classes, the teacher will have students break up into several groups and work on an assignment during class time. This would be a great quiet and open space for students to work together on an assignment. There had been previous problems with the lab being identified as an either classroom or laboratory space. The University requires that the space’s use be clearly defined as a classroom or lab. We have run into several bureaucratic problems regarding this issue, which would be solved if it was defined solely as a classroom space. The costs involved in this solution might include replacing the current chairs and desks that are on wheels, with traditional student desks with individual worktables. This cost could be very high if we were not able to use extra desks that the University has on hand. A disadvantage to this solution is that it does not address the needs of its users, does not promote innovation and creativity, and limits the flexibility of the space. It strays far from the lab’s initial intention and purpose of being a space for students to innovate and design. Also, the budget cuts are hopefully not a long-term problem. Within a few years, California could be back on its feet and constructing new classrooms. This solution is very feasible and would likely increase student and faculty usage.

Ideation Kits

Another alternative that we came up with is to use the current resources and extra funds to create a highly innovative space by providing “ideation kits” for the lab. This would include gathering tools and ordering additional supplies such as post-its, markers, or foam to assemble kits for specific purposes. These kits could include but are not limited to: packaging, technology, paper, brainstorming, prototyping, etc. There are five rolling carts and many tools in the lab that are currently not being utilized. There are industrial glue guns, corrugate, hammers, x-acto knives, tape measures, and many other supplies in the lab that have not been used. This alternative is relatively low cost due to the fact that we would only have to buy the few supplies that are not currently in the Ideation lab or found in other IT labs. Another aspect to this solution would be to attempt to create a unique atmosphere in order to inspire creativity. The lab would then have one primary purpose- ideate. This could be done by painting the walls, hanging artwork and past innovative projects. This solution most definitely meets the intended purpose of

the lab- a place where teams can brainstorm, create, critique, research, fine-tune, and even discard product concepts. The idea behind this purpose is to prepare graduates to meet the risks and challenges of starting and building a business. With the addition of the Entrepreneurship concentration, this lab has the potential to become a vital resource to the curriculum. It also promotes a change or shift within the major by exposing students to ideation practice and entrepreneurship. The pitfall of this alternative is that it reduces the flexibility of the space. The space would not be as “open” to accommodate lectures, host club meetings, or have IT students work on their assigned or own side projects. It would not accommodate its users needs, however, we feel there is a clear disconnect between what users think they need and what they actually need. This solution is most likely very feasible because we are using supplies that we already have; the challenge will be to encourage the users to become familiar with the concept of ideation. The lab’s purpose will be clearly defined. This can be an advantage because students and faculty were confused about the labs purpose and how it should be used and accessed. This defined use can also be a disadvantage if its users do not utilize the lab for its intended purpose.

Proposed Future Design

The last alternative would be to deliver a proposed new design of what we think the lab should look like. Instead of making incremental changes with a limited budget, we would create a new, modern design that could be implemented in the future. Currently, the Ideation lab is a remodel of an old textiles lab and is not modern by any means. It would be difficult for students to ideate and come up with new ideas for the future working in a 1970’s science lab. The windows and tile floor are in bad shape and even pose an asbestos threat to students. If one tile flips up from the flooring, the teacher is to have everyone evacuate the room and call facilities right away to bring in HAZMAT workers to secure the lab. If or when the design could be implemented, it would fulfill the need to advance the department and would be a selling point for the major. It would look attractive to industry and would have the potential to bring attention to the Orfalea College of Business. This would in turn provide new opportunities in terms of jobs for students graduating and also attract future other students to the major. The disadvantage to this solution is that it does not make an concrete changes at this time because it is only a design. The design cost would be zero, but the cost to implement the design would be very high. This alternative is not very feasible due to the bureaucracies of the department, facilities, and the

University. It is unclear now how it would affect the users of the lab. If the right design was created and implemented correctly, it could benefit all the lab's users. One of the future goals of the lab is that its use would extend beyond the department, to other parts of the campus as well as the local community. With a newly designed lab in place, this goal would be ultimately fulfilled.

RESULTS

In an effort to meet the evolving needs of the Industrial Technology department we examined several different options regarding the direction in which we could have taken this project. In this section we will examine five of the options that were presented in the previous section and our considerations before deciding which was best suited to satisfy our needs. These needs included advancing the Industrial Technology department, inspiring innovation and creativity, providing materials and tools for constructing “soft” prototypes, ensuring a flexible space, all while simultaneously maintaining a relatively low budget. This section will further explain why each option was either chosen or dismissed in greater detail.

Leave in Current State

The first potential solution we considered was to leave the lab in the current state it is in, or in other words simply leave the lab "as is." This might sound simple on the surface, but in fact there are actually several aspects and advantages to this potential solution. Many were discussed in the previous section, but the main ones were that this room is currently open to all types of uses by the faculty and students, and continues to remain an “unspecified use” space within the department. This is important to keeping the lab open for use as the department intends, and not classifying it as a "classroom" which would then open it to the entire Orfalea College of Business. We rated this solution as a 1 on the scale from 1 to 5. This was due to the fact that there were no direct benefits to the student body and/or the faculty if this solution was chosen, and it did not enhance the space further than it currently is. The entire purpose behind this project is to complete both of these tasks in some shape or form, and leaving the lab in the current state would accomplish neither. Although this solution is highly feasible and does in fact present some positive aspects, it still received the lowest rating possible when all of the advantages and disadvantages were considered. In regards to the needs set forth in the Introduction section, this solution did in fact satisfy the least important need extremely well, funding. However, it did little to satisfy the most important need because currently the lab lacks the ability to promote innovation and creativity.

Classroom Space

The solution that also received the lowest rating of 1 was to officially change the Ideation Laboratory to a classroom setting. Although some of the advantages of this solution might be welcomed in the next year or two by the instructors, particularly the availability of an extra classroom or perhaps an instructor "breakout room," in the long-run it's feasibility is somewhat tainted. When the economy does begin to take a turn for the better in the next year or two, the space that had so much potential may simply be overlooked as an extra classroom setting, and not properly utilized. The bureaucracy involved also can become a potential problem, as the "lab" vs. "classroom" distinction is extremely important to the University, and the lab may be confiscated or shut down if it is not properly used by the Industrial Technology Department. As well, like the previous solution this does little to advance the major or the department as a whole, so it was a rather simple decision to assign this solution the lowest possible score on the scale. It simply does not have the advantages needed to help the space as well as the department continue to develop and improve in both the near and distant future. The needs this solution satisfies include providing a flexible space that meets the needs of its users, as well as providing students with the tools necessary to create "soft" prototypes. However, it does little to promote innovation and creativity, and creates a potential nightmare as far as access to the space and scheduling logistics are concerned, both of which are of great concern to this project.

Student-Centered

Although the idea of the student-centered space was most widely accepted and supported by the team and the student body, it unfortunately also received a lower score on the spectrum. The "IT Lounge" was a success with the student interviews, and nearly all responses were positive. As well, within the group it seemed the idea of a private, IT only student lounge would have been extremely helpful in our progression through the Industrial Technology curriculum. Nearly every undergraduate class involves some type of group project, and many courses require multiple group gatherings. As the quarter nears an end, finding a space at the Robert E. Kennedy Library is all but impossible, and meeting at individuals' houses seems to always prove to be a difficult task. This solution does in fact satisfy several of the needs set forth in the Introduction, including providing students with the necessary tools, allowing access to the lab with minimal scheduling conflicts, creating a flexible space for the users as well as promoting innovation

and creativity without spending a great deal of money. However, after conferring with faculty and the department, we were quickly told to dismiss this idea, and that it was not feasible from a bureaucratic point of view. One of the major setbacks was that it greatly altered the direction in which those in charge wanted to see the lab move towards, and security of the items inside the lab was also a concern. This was a disappointment to the group, but for these reasons it received a rating of 3 on the 1 to 5 scale. It did in fact satisfy nearly all of the previously set-forth needs and proved to be extremely popular with those who use the lab most, the students, but for one reason or another it simply was not an option to select this choice.

Proposed Future Design

The fourth solution that was set forth by the group was that of a proposed future design. This potential solution does in fact satisfy nearly all of the needs set forth, but also has some negative aspects as well that greatly hinder its practicality. Although it would cost little to nothing to simply create a design and a plan for what the room might someday look at, the cost of actually implementing this plan would be extremely great, and not something that would be possible until the economy picks up. As well, the location of the future lab should be a consideration, as this fifty plus year old current building is scheduled for demolition as soon as the University funds allow. As well, it is tough to inspire creativity for futuristic ideas in a room that was built decades ago. However, in theory this solution meets four out of the five needs with great success. A properly designed Ideation Laboratory would promote innovation and creativity, provide students with every necessary tool needed to create prototypes including an inspiration space in which to do so, and access to the room would allow use when needed by both student groups as well as classroom activities. However, the monetary limitations are great at this point in time, so this solution is best suited to stay in the idea stage. For these reasons this idea received a rather high score of four out of five on the ability to satisfy the needs set forth.

Ideation Kits

The fifth and final solution was the one the group decided met the majority of the needs and fulfilled the purpose of this project. All things considered, it satisfied the needs better than all of the other alternative solutions. Improving the existing lab with Ideation "kits" is a highly feasible opportunity, and one that will in fact benefit its users for the near future. Carts will be

provided for students that will allow them to both brainstorm and take their ideas to the next level by creating "soft" prototypes. A packaging, paper, brainstorming, and prototyping cart might all be provided and set up by our group, which would then allow future student groups to theoretically come up with and test their ideas for classes such as IT 407, *Applied Industrial Product Design*. This room will also be decorated with inspiring and creative past students' projects, as well as seemingly random and often unpredictable toys, paintings, and sculptures from everyday life. This idea would allow students to gain access and understanding as to how a well-run brainstorming and prototyping session is conducted, which would then prepare them for this type of activity after graduation. Also, it would promote innovation, provide the necessary tools, allow access to the space, and require little funding. This works to satisfy, at least partially, each and every need listed in the Introduction section. For these and other reasons our group decided this solution was the only one worth of earning a score of five, and decided accordingly to select this as our choice of action. It also works to advance the major as a whole, and will undoubtedly increase the quality of student projects in the up and coming future of the Industrial Technology Department.

Evaluation

To properly evaluate the performance of the final solution it is important clearly state the parameters that will be used to determine the success of the project. In a project such as this, finding the proper criteria to analyze the effectiveness of the work done on a quantitative level will be quite difficult so must rely on a more qualitative approach.

The first and possibly most important parameter that will be used to determine the effectiveness of our solution will be the amount of ideation accomplished in future of the lab. By looking at the quality and innovativeness in the course work completed within the lab it will be quite clear if the new space is nurturing good ideas and allowing a creative outlet for the students in the Industrial Technology major. It is important to note that if a change is not seen in students work it may not be due, in whole, to a failure of the lab or a misuse of the space.

A second parameter used to establish the effectiveness of the solution will be the degree of which the lab will be integrated into the curriculum of the Industrial Technology department. The lab is a valuable resource that teachers and students should use on a regular basis; if this fails to be realized then it would show the solution to be unsuccessful in meeting the needs of the

people it was originally planned to benefit. One key element to this parameter is the approval of both faculty and students of the lab along with the tools and techniques that are to be used within it. If the faculty does not embrace either of these elements then the students will never be given a chance to use the lab, and if the students don't buy into the ideation methodology then the space will not be taken seriously, showing a failure in the implementation of the lab.

One way to indirectly measure the successes of the solution is to measure the success of the groups that will be using it most. In looking at lab usage figures one group is using the lab for its intended purpose more than any others; the Entrepreneurship Club. This club has been very successful in its early stages and if the success continues then we can assume the solution implemented in the space they reside has helped them achieve this goal.

One last way to measure the successfulness of this solution is to examine the notoriety it holds inside the campus community as well as within the professional world. If this solution is successful the lab will slowly gain recognition and esteem for being a creative space that only the most privileged will be giving the opportunity to utilize.

<u>Needs</u>	Rating
Promote innovation	5
Provide tools for prototyping	5
Flexible space	4
Access to space and schedule	2
Funding (cost)	4

Figure II

5=best 1=worst

Promote innovation – this need is very well met because it is at the heart of our solution

Provide tools for prototyping – the packaging, prototyping and tech cart will fulfill this need

Flexible space – while the space will still be highly flexible there may be too many distractions for daily class use

Access to space – while the students may be spending more time in the lab they do not have open access.

Funding – this option is very cheap (about \$500) it is still not free

CONCLUSION

What we have done

This project was started by obtaining a better understanding of the current state of the lab, and was done with comprehensive faculty interviews. The team went and personally interviewed each of the Industrial Technology faculty and lectures to gain insight into their feelings on the current state of the Ideation/Entrepreneurship Lab. The next step to understanding the current state was to conduct interviews of John York and Cece Reyes to gain insight into the methods used to design and build the lab along with possible area for improvement from their perspective. Once all faculty and staff interviews were completed the area of focus was shifted to the main users of the lab; the students. Student surveys were administered to many Industrial Technology classes in hopes of better understanding the overall perception of the lab including possible uses and disadvantages of the space.

A full literature review was conducted to support the goals of the project and review practices of many companies such as IDEO and other design firms focusing on three main points; ideation and innovation, brainstorming and prototyping. The ideation and innovation section of this review focused mainly on the benefits of the ideation process as a whole while giving a glimpse into the practices used in the industry. The brainstorming section focused mainly on the common practiced techniques used to generate ideas and refine the creation process. In the prototyping section the review focused mainly on the different methods of prototyping and when they are useful.

In an effort to gain more knowledge of the industry the project team headed to the pacific design and manufacturing show armed with information on the Industrial Technology curriculum, basic information on the labs and an overview of the project. Contact was made with a number of companies that offered their support in a number of ways, mostly by giving advice as to what they would like to see students trained in before graduation. Direct contact was made to a number of companies in the industry and discussions were had on a number of subjects including; brainstorming techniques, idea generation, design practices and layout of a typical design studio.

One very strong piece of feedback gathered was the inadequacies of the computers currently in the lab. While these computers have basic word processing and web surfing capabilities many felt they lacked much functionality needed to complete projects. The software needed included SolidWorks 2009, CAPE pack, and ArtiosCAD. One option for the implantation of this software was to install it on the current computers but a software compatibility problem posed some problems leaving only one other option, to install new computers with compatible software. Once implanted these new computers will allow students to use all the software tools necessary for product development and design.

To create an atmosphere and to get the tools necessary for the kits to be made shopping for parts at local thrift and craft stores was undertaken. Focusing on products that would add a certain flavor or style to the room was a primary goal of the shopping trips, these products were aimed at removing the sterile feeling that some experience in the lab while also making it a more creative and comfortable space. A second goal was to purchase products that could be useful in one of the 4 kits that were to be put into practice in the lab, these products were aimed at allowing students to prototype and build crude models or spark creativity while using the lab.

Once all the material was gathered for the kits they were assembled and placed on the carts found in the lab. There are four different carts each with a different intended goal. The packaging cart has material necessary to quickly make a prototype of a box idea to test its functionality. There are also many innovative and extraordinary packages placed on the cart to promote “outside the box” thinking. The second cart constructed is the technology cart, this cart has all the tools necessary to prototype a wide variety of products, items found on this cart could be used to model electronics, mechanical systems, computer systems and most physical products found on the market today. The prototyping cart is used for very basic and quick mock ups of ideas, this cart contains items that will allow students the ability to physically model a part in a matter of second or minutes to describe an idea to a group or better understand the physicality of the product. Our final cart is the brainstorming cart, which serves as a one-stop place to find any tool you may need for brainstorming. This cart contains things like sticky notes and IDEO cards with valuable tips on the brainstorming process to enable the students to effectively generate ideas and properly record them.

In order to add further to the style and character of the room while also adding to the inspirational nature of many items found in the lab many past packaging and design products

where brought into the lab from various other labs within the Industrial Technology department. With the placement of many other incredibly innovative and interesting products into the lab the hope is that students are able to draw on these items for their own inspiration. Additionally the placement of these items allowed for a greater feeling of ownership on behalf of the Industrial Technology students and staff, students are able to see their hard work be displayed proudly in the lab for others to see.

In order to create an atmosphere that will allow for successful brainstorming, the rules for the activity must be clearly stated and followed by everyone sharing the space. To insure that everyone are made aware of these rules, they were placed on the north wall above the white board in large black vinyl lettering. This action was undertaken to be sure that the environment was conducive to ideation and now ideas would be left un-explored.

The last action taken by the team was a comprehensive presentation to the faculty and staff that wish to use the lab to be sure they understand how the space is meant to be used and what each kit is to be used for. This presentation was given the last week of Spring quarter 2010.

What we have learned

Throughout the course of this project many different aspects of IDEO, innovative and creative thinking, as well as other aspects of brainstorming were explored. As the 22 weeks progressed there were many interesting things gathered and learned. This project became a balancing act regarding what certain individuals wanted to see happen with this assignment, including students versus the faculty. As well, it was also a tender subject at times between faculty members themselves. Another essential piece of knowledge that was acquired was the way in which to go about dealing with bureaucratic systems such as Cal Poly. There are always ways to take shortcuts and accomplish tasks “under the table” but this is not the proper way to do so, and there is always the possibility that this may come back to haunt whoever is involved at a later date. Another key element that was helpful in this process was understanding how to work as a team. Tasks were often divided up among members, and all members had to be willing to take on the necessary workload in order to ensure success. This was not a problem in any way, and when needed members of the team even lent each other a helping hand to make the project come together in a timely fashion. Yet another aspect that was brought to light by this project was how crucial the role of ideation is to industry. Companies and corporations must learn how

to embrace innovative and creative thinking if they wish to stay current and up-to-date with industry trends. In a time when new developments and products work to fuel profit margins, it is essential that the brainstorming technique be incorporated and involved with everyday business activities.

Potential Problems with Solution

One problem that may be an issue with our solution is that the majority of students do not understand with the lab is to be used for and what purpose it serves within the department, along with this feeling of confusion over the lab in general is a lack of understanding how to use each of the carts and what purpose they serve. Without proper direction and understanding these kits and the lab in general may not live to see its full potential within the curriculum of the Industrial Technology program.

This lab and project focus on a long-term commitment to improving the departments it serves and must therefore be assessed on a long term scale. One possible problem with the solution provided is that some may expect to see large improvements in a short amount of time and that is just simple not going to be the case, this lab signifies a much larger change in focus that will take some time to be fully realized.

Looking into the group dynamic it is clear to see that only one major problem arose during over the course of this project, a lack of communication. There were a number of times when the group could have been communicating with one another more efficiently but overall, in group communication was satisfactory but communication with other outside the group seemed to pose a problem on more than one occasion. Communication with the faculty advisor was regular both at the beginning and end of the project but the middle points of the project allowed a breakdown in normal and regular communication leading to a slight misdirection in projects goals but was soon straightened out and corrected.

Future Work

To advance the Ideation lab there is much work to be done in near future as well as far. It is imperative that both the students and faculty take ownership of the lab in the long run or else the project and the lab will never fully reach its potential. It is also very important that someone,

either a group or person takes personal ownership over the lab and keeps it clean and organized or else the workspace will become over cluttered and unusable.

There must also be continual improvements made to the lab, such as rotating new projects and the continuation of shopping for new prototyping supplies and interesting gadgets to keep the lab new and exciting for the people using it. There is also a need of a way to check the inventory of lab materials to insure the students always have to proper tools and supplies when trying to use the lab.

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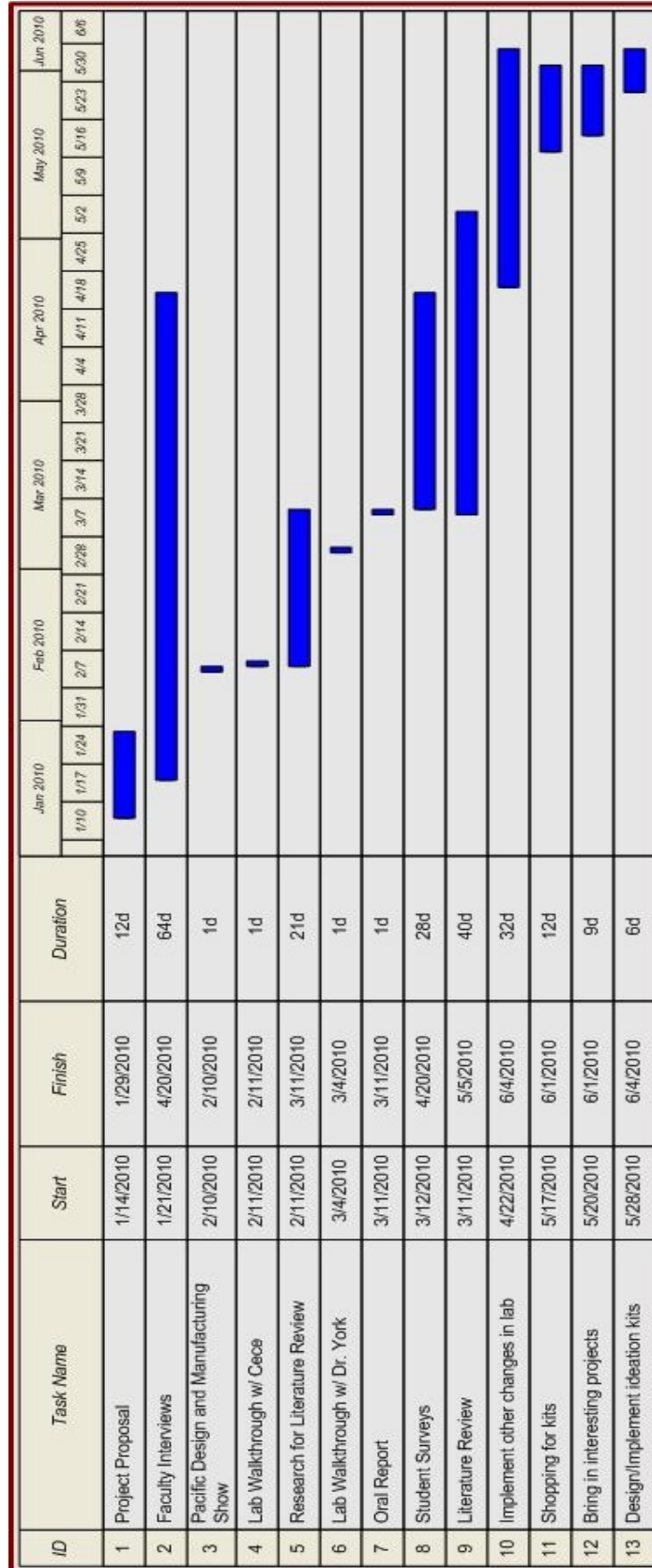
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Gantt Chart



Inventory Lists of each Ideation Cart

Tech Cart Materials
legos wooden blocks motor/ mechanical parts gears magnets cloth bands various trypes of string zip ties metal tubes nuts and bolts metal slinky

Packaging Cart Materials
24" T- rules 12" Metal squares 3 corrugate creasers 2 x-acto knives w/ spare blades corrugate various sizes innovative packages rubber cutting mats paperboard tape measures masking tape wooden rulers

Ideation Cart Materials
various colored post-it note pads toys trivia cars IDEO method cards puzzles flip-chart markers thumb tacs

Prototyping Cart Materials
modeling clay rulers scissors tape markers crayons acrylic paint colored paper foam chalk glue guns

Pictures of Ideation Carts



FIGURE A. TECH CART



FIGURE B. PACKAGING CART



FIGURE C. IDEATION CART



FIGURE D. PROTOTYPING CART

Pictures of Entrepreneurship Ideation Lab Post- Project



FIGURE E. COMPLETED CARTS



FIG. F. HIGH TABLES AND COMPUTERS



FIG. G. MOVABLE DESKS AND CHAIRS